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DB Name	Query	Hit Count	Set Name
USPT	l11 and (transparent)and (sensor)and (substrate)and (display)and (rigid)	1	L17
USPT	l11 and (transparent)and (sensor)and (substrate)and (display)	7	L16
USPT	l11 and (transparent)and (sensor)and (substrate)	7	L15
USPT	l11 and (transparent)and (sensor)and (LCD)	1	L14
USPT	l11 and (transparent)and (sensor)	8	L13
USPT	l11 and (transparent)	8	L12
USPT	5305017	43	L11
USPT	l8 and (touchpad)and (transparent)	1	L10
USPT	l8 and (touchpad)	5	L9
USPT	5543588	38	L8
USPT	((345/173)!.CCLS.) and ("transparent touchpad")	1	L7
USPT	l1 and (touchpad)and (transparent)and (sensor)and (capacitive)and (substrate)	1	L6
USPT	l1 and (touchpad)and (transparent)and (sensor)and (capacitive)	1	L5
USPT	l1 and (touchpad)and (transparent)and (sensor)	1	L4
USPT	l1 and (touchpad)and (transparent)	1	L3
USPT	l1 and (touchpad)	1	L2
USPT	5952998	1	L1

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L18: Entry 9 of 9 File: USPT Mar 9, 1999

US-PAT-NO: 5880411
DOCUMENT-IDENTIFIER: US 5880411 A

TITLE: Object position detector with edge motion feature and gesture recognition

DATE-ISSUED: March 9, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Gillespie; David W.	Palo Alto	CA	N/A	N/A
Allen; Timothy P.	Los Gatos	CA	N/A	N/A
Wolf; Ralph C.	Santa Clara	CA	N/A	N/A
Day; Shawn P.	San Jose	CA	N/A	N/A

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Synaptics, Incorporated	San Jose	CA	N/A	N/A	02

APPL-NO: 8/ 623483
DATE FILED: March 28, 1996

PARENT-CASE:
RELATED APPLICATIONS This application is a continuation-in-part of co-pending application Ser. No. 08/320,158, filed Oct. 7, 1994, which is a continuation-in-part of application Ser. No. 08/300,387, filed Sep. 2, 1994, now abandoned which is a continuation-in-part of application Ser. No. 08/115,743, filed Aug. 31, 1993, now U.S. Pat. No. 5,374,787, which is a continuation-in-part of application Ser. No. 07/895,934, filed Jun. 8, 1992, now abandoned.

INT-CL: [6] G08C 21/00, G09G 5/08, G09G 5/00
US-CL-ISSUED: 178/18.01; 178/19.01, 345/157, 345/159, 345/173
US-CL-CURRENT: 178/18.01; 178/19.01, 345/157, 345/159, 345/173
FIELD-OF-SEARCH: 178/18.01, 178/19.01, 178/20.01, 345/157, 345/159, 345/160, 345/173, 345/174, 382/119, 382/186, 382/187, 382/316

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected | Search ALL

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
Re23030	August 1948	Holt	N/A
2219497	October 1940	Stevens et al.	N/A

☐	3128458	April 1964	Romero	N/A
☐	3207905	September 1965	Bray	N/A
☐	3244369	April 1966	Nassimbene	N/A
☐	3401470	September 1968	Gaven	N/A
☐	3437795	April 1969	Kuljian	N/A
☐	3482241	December 1969	Johnson	N/A
☐	3492440	January 1970	Cerbone et al.	N/A
☐	3493791	February 1970	Adelson et al.	N/A
☐	3497617	February 1970	Ellis et al.	N/A
☐	3497966	March 1970	Gaven	N/A
☐	3516176	June 1970	Cleary et al.	N/A
☐	3522664	August 1970	Lambright et al.	N/A
☐	3530310	September 1970	Adelson et al.	N/A
☐	3543056	November 1970	Klein	N/A
☐	3549909	December 1970	Adelson et al.	307/252
☐	3593115	July 1971	Dym et al.	323/93
☐	3598903	August 1971	Johnson et al.	178/18
☐	3662378	May 1972	MacArthur	340/347DD
☐	3675239	July 1972	Ackerman et al.	340/365
☐	3683371	August 1972	Holz	340/365
☐	3696409	October 1972	Braaten	340/365
☐	3732389	May 1973	Kaelin et al.	200/167A
☐	3737670	June 1973	Larson	307/116
☐	3757322	September 1973	Barkan et al.	340/365C
☐	3760392	September 1973	Stich	340/200
☐	3773989	November 1973	Hacon	200/52R
☐	3875331	April 1975	Halsenbalg	178/19
☐	3921166	November 1975	Volpe	340/365C
☐	3931610	January 1976	Marin et al.	340/172.5
☐	3932862	January 1976	Graven	340/324M
☐	3974332	August 1976	Abe et al.	178/18
☐	3992579	November 1976	Dym et al.	178/18
☐	3999012	December 1976	Dym	178/18
☐	4056699	November 1977	Jordan	200/5A
☐	4058765	November 1977	Richardson et al.	324/61R
☐	4071691	January 1978	Pepper, Jr.	178/19
☐	4087625	May 1978	Dym et al.	178/19
☐	4103252	July 1978	Bobick	331/48

☐	4129747	December 1978	Pepper, Jr.	178/19
☐	4148014	April 1979	Burson	340/709
☐	4177354	December 1979	Mathews	178/18
☐	4177421	December 1979	Thornburg	324/61R
☐	4198539	April 1980	Pepper, Jr.	178/18
☐	4221975	September 1980	Lednicki et al.	307/116
☐	4224615	September 1980	Penz	340/712
☐	4246452	January 1981	Chandler	200/5A
☐	4257117	March 1981	Besson	368/69
☐	4264903	April 1981	Bigelow	340/365C
☐	4281323	July 1981	Burnett et al.	340/712
☐	4290052	September 1981	Eichelberger et al.	340/365C
☐	4290061	September 1981	Serrano	340/712
☐	4291303	September 1981	Cutler et al.	340/711
☐	4293734	October 1981	Pepper, Jr.	178/18
☐	4302011	November 1981	Pepper, Jr.	273/85
☐	4310839	January 1982	Schwerdt	340/712
☐	4313113	January 1982	Thornburg	345/159
☐	4334219	June 1982	Paulus et al.	340/712
☐	4371746	February 1983	Pepper, Jr.	178/18
☐	4398181	August 1983	Yamamoto	340/365S
☐	4423286	December 1983	Bergeron	178/19
☐	4430917	February 1984	Pepper, Jr.	84/1.01
☐	4442317	April 1984	Jandrell	178/18
☐	4455452	June 1984	Schuyler	178/18
☐	4475235	October 1984	Graham	382/3
☐	4476463	October 1984	Ng et al.	340/712
☐	4511760	April 1985	Garwin et al.	178/18
☐	4516112	May 1985	Chen	340/365
☐	4526043	July 1985	Boie et al.	73/862.04
☐	4550221	October 1985	Mabusth	178/18
☐	4550310	October 1985	Yamaguchi et al.	340/365
☐	4554409	November 1985	Mitsui et al.	178/19
☐	4570149	February 1986	Thornburg et al.	338/114
☐	4582955	April 1986	Blesser	178/19
☐	4595913	June 1986	Aubuchon	340/365
☐	4616107	October 1986	Abe et al.	178/18
☐	4639720	January 1987	Rympalski et al.	340/712

☐	4672154	June 1987	Rodgers et al.	178/19
☐	4680430	July 1987	Yoshikawa et al.	178/19
☐	4686332	August 1987	Greanias et al.	178/19
☐	4698461	October 1987	Meadows et al.	178/19
☐	4733222	March 1988	Evans	340/365C
☐	4734685	March 1988	Watanabe	340/710
☐	4736191	April 1988	Matzke et al.	340/365C
☐	4758690	July 1988	Kimura	178/19
☐	4766423	August 1988	Ono et al.	340/709
☐	4788385	November 1988	Kimura	178/19
☐	4794208	December 1988	Watson	178/19
☐	4820886	April 1989	Watson	178/19
☐	4853498	August 1989	Meadows et al.	178/19
☐	4914624	April 1990	Dunthorn	364/900
☐	4918262	April 1990	Flowers et al.	178/18
☐	4922061	May 1990	Meadows et al.	178/19
☐	4935728	June 1990	Key	340/709
☐	4988982	January 1991	Rayner et al.	345/173
☐	5016008	May 1991	Gruaz et al.	341/33
☐	5117071	May 1992	Greanias et al.	178/19
☐	5120907	June 1992	Shinbori et al.	478/18
☐	5149919	September 1992	Greanias et al.	178/19
☐	5153572	October 1992	Caldwell et al.	340/712
☐	5194862	March 1993	Edwards	341/20
☐	5231450	July 1993	Daniels	355/27
☐	5239140	August 1993	Kuroda et al.	178/18
☐	5270711	December 1993	Knapp	341/34
☐	5327161	July 1994	Logan et al.	345/157
☐	5365254	November 1994	Kawamoto	345/157
☐	5369227	November 1994	Stone	178/18
☐	5373118	December 1994	Watson	178/19
☐	5374787	December 1994	Miller et al.	178/18
☐	5386219	January 1995	Greanias et al.	345/174
☐	5408593	April 1995	Kotaki et al.	395/122
☐	5488204	January 1996	Mead et al.	345/179

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0 187 372	December 1985	EPX	
0 394 614	October 1990	EPX	
0 490 001	June 1992	EPX	
0 574 213	December 1993	EPX	
0 589 498	March 1994	EPX	
0 609 021	August 1994	EPX	
2 662 528	May 1990	FRX	
60-205625	October 1985	JPX	
62-126429	June 1987	JPX	
63-073415	April 1988	JPX	
2 040614	February 1990	JPX	
4 015725	January 1992	JPX	
06 139022	May 1994	JPX	
07 072 976	March 1995	JPX	
2 139 762	November 1984	GBX	
2 266 038	October 1993	GBX	
2 288 665	April 1995	GBX	
91/03039	March 1991	WOX	
91/05327	April 1991	WOX	
96/07966	March 1996	WOX	
96/11435	April 1996	WOX	
96/18179	June 1996	WOX	

OTHER PUBLICATIONS

"Pressure-Sensitive Icons", IBM Technical Disclosure Bulletin, Jun. 1990, vol. 33, No. 1B, pp. 277-278.
"Scroll Control Box", IBM Technical Disclosure Bulletin, Apr. 1993, vol. 36, No. 4, pp. 399-403.
Wilton, Microsoft Windows 3 Developer's Workshop, 1991, pp. 229-230.
Tiburtius, "Transparente Folientastaturen", Feinwerktechnik & Messtechnik 97, No. 7, Munchen, DE, Jul. 1989, pp. 299-300.
"Double-Click Generation Method for Pen Operations", IBM Technical Disclosure Bulletin, Nov. 1992, vol. 35, No. 6, p. 3.
"Three-Axis Touch-Sensitive Pad", IBM Technical Disclosure Bulletin, Jan. 1987, vol. 29, No. 8, pp. 3451-3453.
Chun, et al., "A High-Performance Silicon Tactile Imager Based on a Capacitive Cell", IEEE Transactions on Electron Devices, Jul. 1985, vol. ED-32, No. 7, pp. 1196-1201.

ART-UNIT: 275
PRIMARY-EXAMINER: Shankar; Vijay
ATTY-AGENT-FIRM: D'Alessandro & Ritchie

ABSTRACT:

Methods for recognizing gestures made by a conductive object on a touch-sensor pad and for cursor motion are disclosed. Tapping, drags, pushes, extended drags and variable drags gestures are recognized by analyzing the position, pressure, and movement of the conductive object on the sensor pad during the time of a suspected gesture, and signals are sent to a host indicating the occurrence of these gestures. Signals indicating the position of a conductive object and distinguishing between the peripheral portion and an inner portion of the touch-sensor pad are also sent to the host.

64 Claims, 40 Drawing figures

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USPT	L8 ans (transparent)	246704	L20
USPT	l18 and (transparent)	0	L19
USPT	5880411	9	L18
USPT	l11 and (transparent)and (sensor)and (substrate)and (display)and (rigid)	1	L17
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USPT	l11 and (transparent)and (sensor)and (LCD)	1	L14
USPT	l11 and (transparent)and (sensor)	8	L13
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USPT	5305017	43	L11
USPT	l8 and (touchpad)and (transparent)	1	L10
USPT	l8 and (touchpad)	5	L9
USPT	5543588	38	L8
USPT	((345/173)!.CCLS.) and ("transparent touchpad")	1	L7
USPT	l1 and (touchpad)and (transparent)and (sensor)and (capacitive)and (substrate)	1	L6
USPT	l1 and (touchpad)and (transparent)and (sensor)and (capacitive)	1	L5
USPT	l1 and (touchpad)and (transparent)and (sensor)	1	L4
USPT	l1 and (touchpad)and (transparent)	1	L3
USPT	l1 and (touchpad)	1	L2
USPT	5952998	1	L1

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L6: Entry 1 of 1 File: USPT Sep 14, 1999

DOCUMENT-IDENTIFIER: US 5952998 A
TITLE: Transparent touchpad with flat panel display for personal computers

ABPL:
A personal computer includes a flat panel or LCD display for displaying computer status information. The display includes an overlying transparent touchpad. When the touchpad is touched, appropriate signals are processed so that movements of the user's finger on the touchpad can be indicated by displaying altered images on the display that correspond to the movement of the user's finger. In this way, the user gets an immediate visual feedback through the LCD display of what changes can be or have been made by touchpad control.

BSPR:
This invention relates generally to displays for displaying various functions of personal computers and more particularly to the use of a touchpad with a visual display for such devices.

BSPR:
In addition, many computers include a touchpad which allows a cursor to be moved on the computer's LCD screen or monitor. Commonly, a touchpad area is provided near the keyboard. The user can touch the touchpad and move his or her finger to move a cursor display on the screen. One such touchpad is disclosed in U.S. Pat. No. 5,374,787, to Miller et al., which is hereby incorporated by reference herein.

BSPR:
In accordance with one aspect of the present invention, a touchpad for a personal computer includes a substantially transparent substrate. An array of conductive traces are formed on the upper and lower surfaces of the substrate. A flat panel display is situated beneath the substrate so as to project images upwardly through the substrate to enable the computer user to visualize the images. The conductive traces are adapted to allow the user's finger to be capacitively located in response to user proximity. The traces are arranged to permit the image produced by the display to be viewed by the user.

BSPR:
In accordance with another aspect of the present invention, a personal computer includes a microprocessor and memory for controlling the operation of the computer. The microprocessor and memory are contained in a housing. A flat panel display on the housing is connected to the microprocessor. The flat panel display includes a substantially transparent touchpad. The touchpad is situated on top of the display. The touchpad includes a substantially transparent substrate and an array of conductive traces formed on the upper and lower surfaces of the substrate. The touchpad is adapted to convert proximity with the touchpad into signals indicative of the position of the user's finger on the touchpad.

BSPR:
In accordance with still another aspect of the present invention, a method for controlling the operation of a personal computer by monitoring status

information includes the step of forming a substantially transparent touchpad having a substantially transparent substrate and an array of conductive traces formed on its upper and lower surfaces. The substrate is situated over a flat panel display. Visual images are produced on the flat panel display in such fashion that the images are arranged to substantially project through the array of traces on the substrate.

DRPR:
FIG. 2 is an enlarged front elevational view of the LCD touchpad display shown on the keyboard enclosure of the computer in FIG. 1;

DRPR:
FIG. 6 is an enlarged view of one of the capacitive elements shown in FIG. 5;

DEPR:
Referring to the drawings wherein like reference characters are utilized for like parts throughout the several views, a personal computer 10, shown in FIG. 1, has a conventional keyboard 18 with function keys 12, a liquid crystal display screen 14, and a flat panel or liquid crystal display (LCD) touchpad 16 shown in position at the lower portion of the keyboard enclosure 19. As explained hereinafter, although the present invention has been illustrated as being implemented in connection with a notebook personal computer, it would be apparent to those skilled in the art that the invention could also be implemented on any other type or size of personal computer.

DEPR:
The touchpad 16 is an integrated touchpad which includes a display 20 viewable through a transparent touchscreen 22, as shown in FIG. 3. Underneath the transparent touchscreen 22 is a conventional display 20 sized to fit in an appropriate location in the keyboard enclosure 19. While an LCD display is advantageous as the display 20, other light sources such as LEDs may be used to provide useful information to the computer user through a flat panel display. Thus, the user can touch the touchpad 16 and in so doing, activate the transparent touchscreen 22 to provide an indication of where the user has contacted the touchpad 16.

DEPR:
A variety of screen formats or menus can be produced on the touchpad 16 through the function keys 12. In this way, the user can select a desired menu from a series of menus to input particular control selections. For example, status indications implemented by distinct menus selected by the function keys 12 could include whether magnetic storage devices are operational, the remaining computer battery life, screen brightness or contrast, power conservation settings and other information conventionally displayed on the keyboard 18 or on demand on the display 14 of personal computers. Also, a conventional mouse pointer screen can be implemented whereby the user can touch and move the displayed pointer 80, as shown in FIG. 2. In this way, a large amount of information may be transferred in the relatively small space currently occupied by pointing devices in conventional notebook computers.

DEPR:
The PCI bus 48 may be connected by a bridge 58 to a conventional Industry Standard Architecture or ISA bus 60. A variety of conventional devices may be connected to the ISA bus 60, as depicted in FIG. 3, including the audio controller 62 and the keyboard controller 64. The keyboard controller 64 receives inputs from a conventional keyboard 18 as well as from the touchpad controller 66. Also, the LCD controller/driver 56 is used to drive the display on the LCD display 20.

DEPR:
The touchpad controller 66 receives electrical signals from the substantially transparent touchscreen 22 indicative of the current coordinates of any contact or proximity with the touchpad 16. It converts these signals into a form which is conventionally handled by keyboard controller 64 including those produced by rollerball or other conventional pointing devices. For example,

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USPT	l1 and (touchpad)and (transparent)and (sensor)	1	L4
USPT	l1 and (touchpad)and (transparent)	1	L3
USPT	l1 and (touchpad)	1	L2
USPT	5952998	1	L1

along a trace 72 or 76, substantially greater than its width "W" measured transversely to the trace 72, 76 length, as shown in FIG. 6. In the illustrated embodiment, a diamond shaped element 74 is illustrated but other geometric shapes are also possible. By making the capacitive element 74 length substantially greater than its width, interference with light passing through the touchscreen 22 may be lessened. Advantageous, the capacitive element 74 aspect ratio (L/W) is greater than 2.

DEPR:
The construction of the touchscreen 22, as shown in FIG. 7, may include an upper layer 78 which may conveniently be a transparent plastic film. The purpose of the layer 78 is to avoid removal of the conductive traces 72 through touching and to provide a protective layer for the membrane 70. Thus, the layer 78 may be very thin. The membrane 70 may be secured to the lower surface of the layer 78 such that its upper surface 75 and lower surface 77 are arranged one above the other, and the membrane 70 acts as a dielectric to separate the conductive traces. A screen 20 is then secured below the layer 77.

DEPR:
The traces 72 and 76 form an array that detects the position of the user's finger on or near the touchscreen 22 through capacitive effects. The traces 72 and 76 may, in some embodiments, also provide information about the size of the finger contact and this information may be used to determine finger pressure.

DEPR:
A single sensor processor chip (not shown) can be connected to the traces 72 and 76. The traces 72 and 76 may be driven and sensed in parallel. For example, the voltages on all of the traces 72 may be changed while the voltages on the traces 76 are kept constant. Thereafter, all of the traces 76 are subjected to a changing voltage while the traces 72 are kept at a constant voltage. The elements 74 then apply a capacitive effect to the extent that the user's finger is proximate. The circuitry for decoding the signals received as a result of scanning in this fashion is well known, as disclosed for example, in the aforementioned U.S. Pat. No. 5,374,787.

DEPR:
As shown in FIG. 8, through appropriate arrangement of the traces 72 and 76, images may be projected by the LCD display 20 through the transparent membrane 70 and layer 78, for viewing by the user. In the case where the traces 72 and 76 are not completely transparent, the capacitive elements and traces may interfere to some degree with the image. However, by making the image sufficiently bold, positioning it appropriately, and sizing the array of traces 72 and 76 to leave substantial room for light to project through the array, adequate visualization can be achieved.

DEPR:
Thus, referring to FIG. 8, the ramp-shaped images 26 and 28 are positioned to avoid the predominant capacitive elements 74 and the cursors 27 and 28 are sized sufficiently large to be viewed even if they are partially obscured by capacitive elements 74 or traces 72 or 76. Similarly, the mouse button images 30 and 32 may be deliberately positioned between the traces 72 and 76 so as not to be substantially obscured by the array of conductive traces 72 and 76.

CLPR:
1. A touchpad for a personal computer comprising:

CLPR:
2. The touchpad of claim 1 wherein said display is a liquid crystal display.

CLPR:
3. The touchpad of claim 2 including a substantially transparent layer situated on top of said substrate.

CLPR:
4. The touchpad of claim 1 wherein said elements are diamond shaped.

CLPR:
5. The touchpad of claim 1, wherein said display is comprised of light emitting diodes.

CLPR:
6. The touchpad of claim 1, wherein the image arranging includes positioning and shading said image.

CLPR:
7. A touchpad for a personal computer comprising:

CLPR:
9. The computer of claim 8 including a substantially transparent layer situated on top of said substrate.

CLPR:
16. The method of claim 15, wherein the step of forming conductive traces includes forming a series of parallel traces on an upper surface of the substrate and forming a series of parallel traces on the lower surface, the upper surface traces being substantially perpendicular to the lower surface traces, the upper and lower surface traces together forming an array of apertures for passing the image in an orthogonal direction through the substrate.

CLPR:
17. The method of claim 16 including the step of determining the position of a user's finger on said touchpad using said traces.

CLPV:
a substantially transparent substrate having upper and lower surfaces;

CLPV:
a series of nontransparent conductive traces formed on the upper and lower surfaces of said substrate to form an array operable to capacitively sense a location of an object placed in proximity to the substrate, said traces having a series of capacitive elements arranged along said traces, said capacitive elements being shaped to have a length along said traces which is substantially greater than their width measured transversely to the length of said traces; and

CLPV:
a display, situated beneath said substrate so as to project a image upwardly through said substrate to enable a computer user to visualize said image, said image being arranged so as to substantially avoid interference from said capacitive elements.

CLPV:
a substantially transparent substrate;

CLPV:
an array of conductive traces formed on the upper and lower surfaces of said substrate;

CLPV:
wherein said conductive traces include a series of capacitive elements arranged along said traces to allow finger position to be capacitively determined;

CLPV:
wherein said capacitive elements have a length along the traces which is substantially greater than their width measured transversely to the length of said traces:

CLPV:
a flat panel display situated beneath said substrate so as to project images upwardly through said substrate to enable the computer user to visualize said images, said conductive traces being adapted to allow the user's finger to be located in response to user proximity said traces being arranged so as to permit the image produced by the display to be viewed by the user.

CLPV:
a touchpad attached to said housing and coupled to said microprocessor, comprising:

CLPV:
a display situated beneath said touchpad, coupled to said microprocessor, and operable to project an image, said image being arranged to project through said touchpad without substantial interference from said capacitive elements.

CLPV:
a flat panel display on said housing connected to said microprocessor, said flat panel display including a substantially transparent touchpad, said touchpad situated on top of said display, said touchpad including a substantially transparent substrate and an array of conductive traces formed on the upper and lower surfaces of said substrate, wherein said conductive traces include a series of capacitive elements arranged along said traces to allow finger position to be capacitively determined, wherein said capacitive elements have a length along the traces which is substantially greater than their width measured transversely to the length of said traces, wherein the aspect ratio of said elements is greater than 2, said touchpad being adapted to convert proximity with said touchpad into signals indicative of the position of the user's finger on said touchpad.

CLPV:
forming a series of nontransparent conductive traces on an upper and lower surface of a substantially transparent substrate;

CLPV:
forming a series of capacitive elements along said traces, said capacitive elements being shaped to have a length along the traces of at least twice their width measured transversely to the length of the traces;

CLPV:
positioning said substrate over a display; and

CLPV:
arranging images for said display to project in such fashion that said images substantially avoid interference from said capacitive elements.

CLPW:
a substantially transparent substrate; and

CLPW:
a series of nontransparent conductive traces on an upper and lower surface of said substrate to form an array operable to capacitively sense a location of an object placed in proximity to the substrate, said traces having a plurality of capacitive elements positioned along said traces, each capacitive element being shaped to have a length along said traces substantially greater than its width measured transversely to the length of said traces; and

the PS/2 keyboard/mouse communication protocol can be used to communicate with the touchpad 16. Alternatively, an inter-IC (I.sup.2 C) bus, or a universal serial bus (USB) 65 connects the LCD controller/driver 56 and the keyboard controller 64. The touchpad controller 66 converts the analog signals from the touchscreen 22 into digital signals and provides analog filtering and signal conditioning.

DEPR:
In use, the user simply presses the appropriate function keys 12 in order to cause the desired display or menu to appear on the touchpad 16. The user then can adjust the controls for the processor 10 by making manual movements on the touchpad 16. For example, as shown in FIG. 2, the user can move the cursors 27 or 28 to increase the volume of the audio, for example, in a multimedia system or to adjust screen 14 brightness.

DEPR:
As the cursors 27 and 28 are moved, inputs are provided to the LCD driver 56 and graphics controller 54 which shift the LCD image on the screen 20 to conform the virtual movements of the cursors 27 and 28 to the movement of the user's finger. In other words, as the user moves his or her finger over the LCD touchpad 16, a cursor 27 or 28, acting as a scale indicator, moves with the user's finger. Alternatively, the amount of shading inside each ramp-shaped image 24 or 26 may be increased or decreased to act as a scale indicator. The LCD image will appear to be displaced to the position where the user removes his or her finger from the LCD touchpad 16.

DEPR:
In this way, the user can cycle through a wide variety of computer controls using a very limited surface on the keyboard 18. The user can then adjust any controls that are desired in an advantageous way because the touchpad 16 provides immediate visual feedback and an immediate graphical indication of what changes have been made.

DEPR:
Referring now to FIG. 4, a technique for forming the transparent touchscreen 22 is illustrated. The touchscreen 22 may be formed from a membrane 70 which is preferably substantially transparent to light. A plurality of conductive traces 72 having capacitive elements 74 are formed on the upper surface of the membrane 70.

DEPR:
The membrane 70 may be formed of a variety of materials, including Mylar and transparent plastic film, advantageously made as thin as possible for the application. The traces 72 may be formed by printing a suitably conductive ink on the membrane 70 so as to allow conduction along the traces 72. For example, the conductive materials forming the trace 72 and the capacitive elements 74, may be formed by silkscreening or other printing techniques.

DEPR:
The traces 72 and capacitive elements 74 may be formed of substantially transparent conductive material, such as indium tin oxide or "ITO" deposited by conventional techniques, such as sputter deposition and etched to appropriate shapes. Any other conventionally available transparent conductive materials may be used to form the traces 72 and the capacitive elements 74 .

DEPR:
The lower side 77 of the membrane 70, as shown in FIG. 5, also may have traces formed on it. Advantageously, the traces 76 include capacitive elements 74 and run generally transversely to the direction that the traces 72 extend on the opposite surface 75. Thus, in FIG. 5, since the membrane 70 is substantially transparent, the traces 72 on the upper surface 75 are shown in dotted lines as they would be viewed through the substantially transparent membrane 70.

DEPR:
Each of the capacitive elements 74 may be formed with its length "L," measured